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Electrocatalytic conversion of biomass-derived chemicals in alkaline electrochemical cell

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The overall aim in the EU funded TERRA project is to develop a novel type of electrochemical reactor, in which both the anode and cathode reaction is used for simultaneous electrochemical conversion/upgrading of biomass-derived chemicals.

The electrochemical reactor under development is essentially an alkaline electrolysis cell which will operate in the temperature regime 50° C – 200 °C. One of the important tasks within the project is to identify suitable electrode materials and operating conditions for conversion of xylitol into glycols (cathode reaction) and for conversion of HMF into FDCA (anode reaction). In both cases key parameters to be evaluated are the activity, selectivity and durability for the electrode processes.

For the xylitol conversion a series of electrodes has been investigated, including electrodes based on non-noble metal nanoparticles supported on carbon nanotubes, Pt coated Ti-felt and commercial Pt-black infiltrated carbon felt. The investigation has been carried out in the temperature range from 25° C – 200 °C at 40 bar pressure, and the influence of applied potential and pH-value has been evaluated.

At elevated temperatures (150 -200° C) an electrochemically activated conversion of xylitol is taking place, and conversion of close to 100% xylitol is achieved. The electrodes appear stable within the 1-4 hours duration of each test, however the selectivity of the process towards glycol formation is still very low, and has to be improved.